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(54) **LAYOUT STRUCTURE OF THE FUEL PUMP OF A MOTORCYCLE**

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(52) **U.S. Cl.** **180/219**; 180/69.4; 123/509
(58) **Field of Search** 180/219, 225; 123/509, 69.4

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(57) **ABSTRACT**

In a motorcycle in which a rear wheel is suspended by a rear-wheel suspending part provided of a body frame, a fuel tank is attached in an upper portion of the body frame, an engine is attached in a lower portion of the body frame, a fuel injection valve is provided on the intake side of the engine, and fuel in the fuel tank is supplied to the fuel injection valve by a fuel pump, the fuel pump is attached to the body frame near the rear wheel suspending part. The degree of freedom of layout of the fuel pump can be increased and the fuel pump can be disposed in a position far from the engine, so that thermal effects of the engine onto the fuel pump can be suppressed.

5 Claims, 6 Drawing Sheets

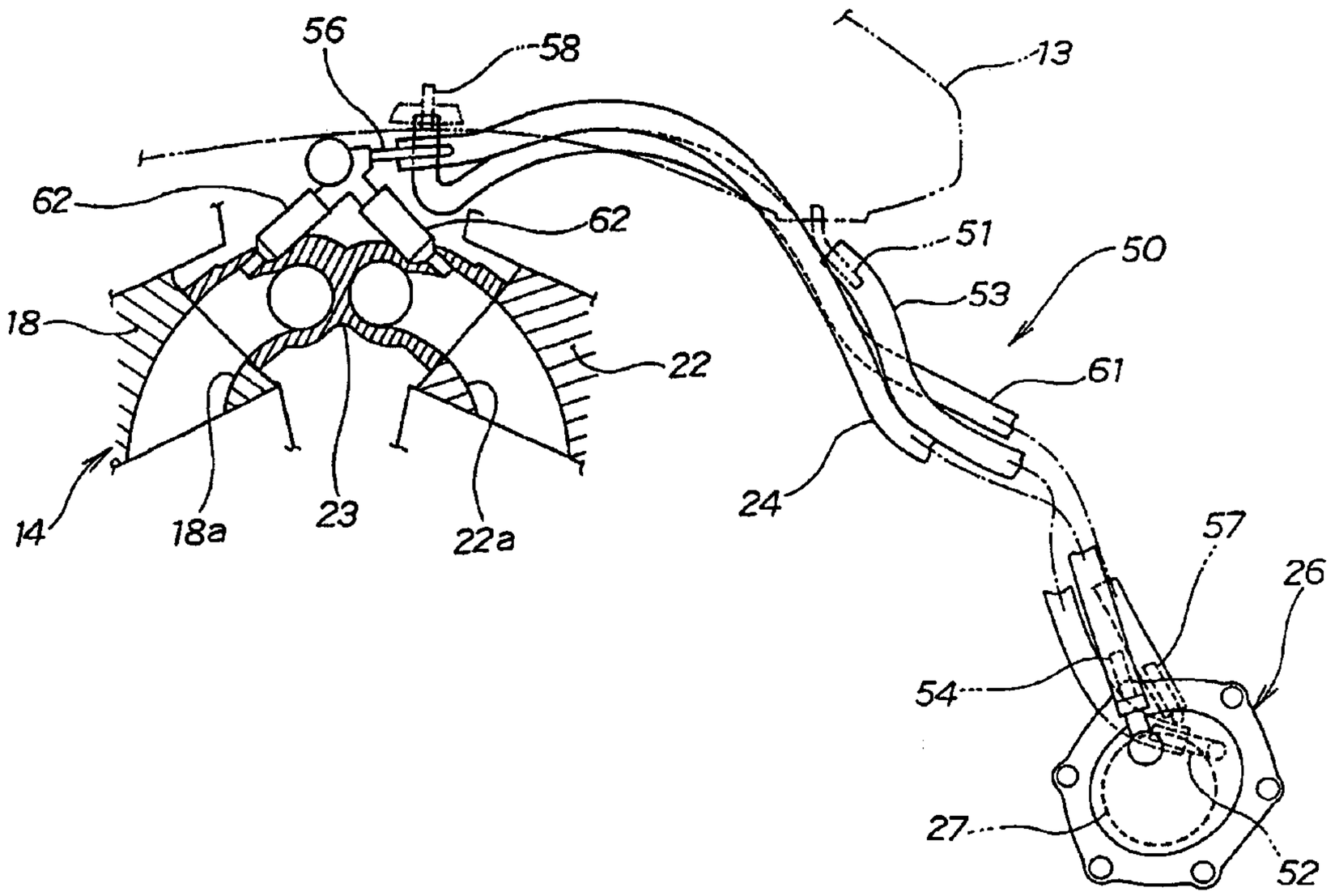

FIG. 1

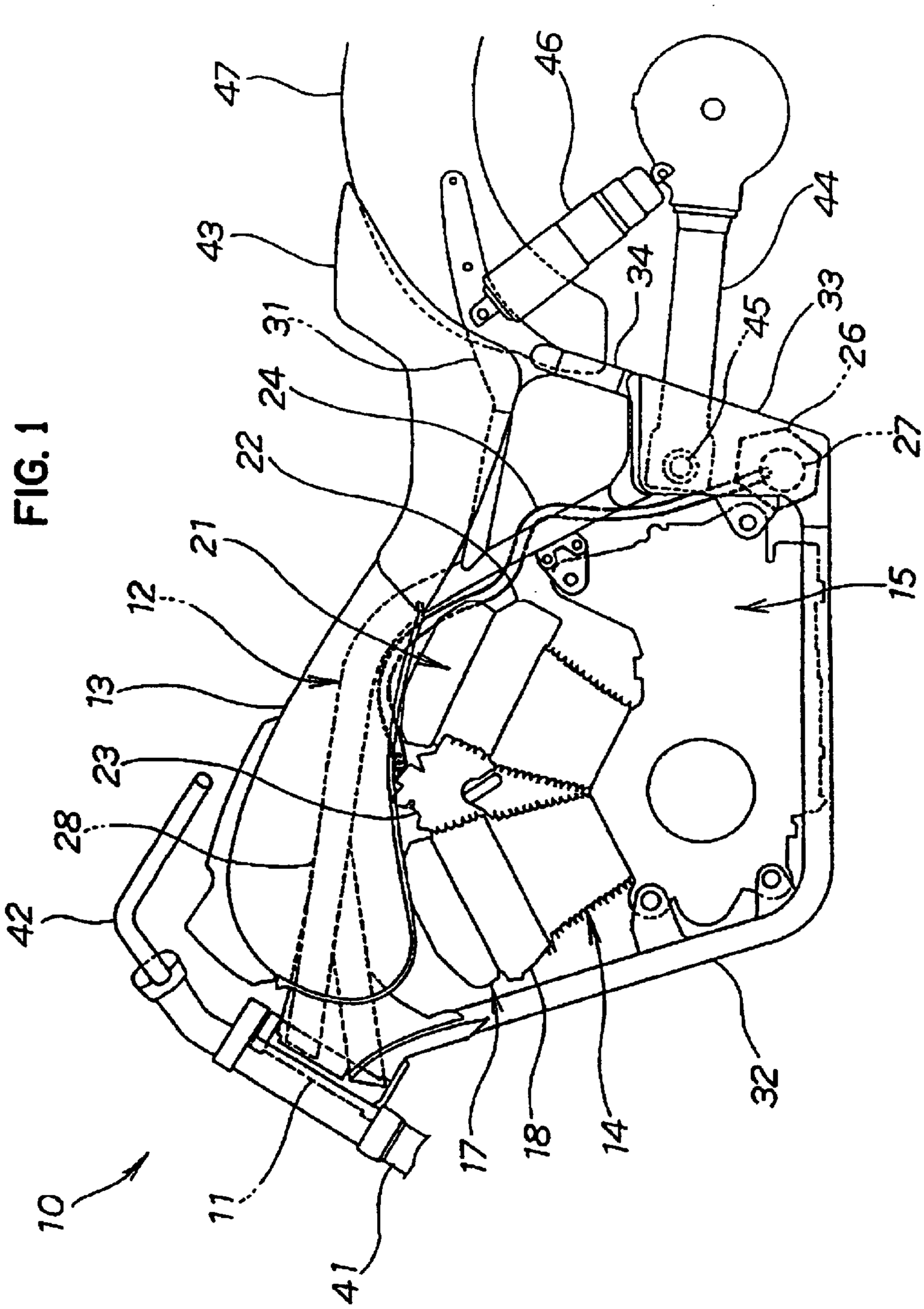
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FIG. 2

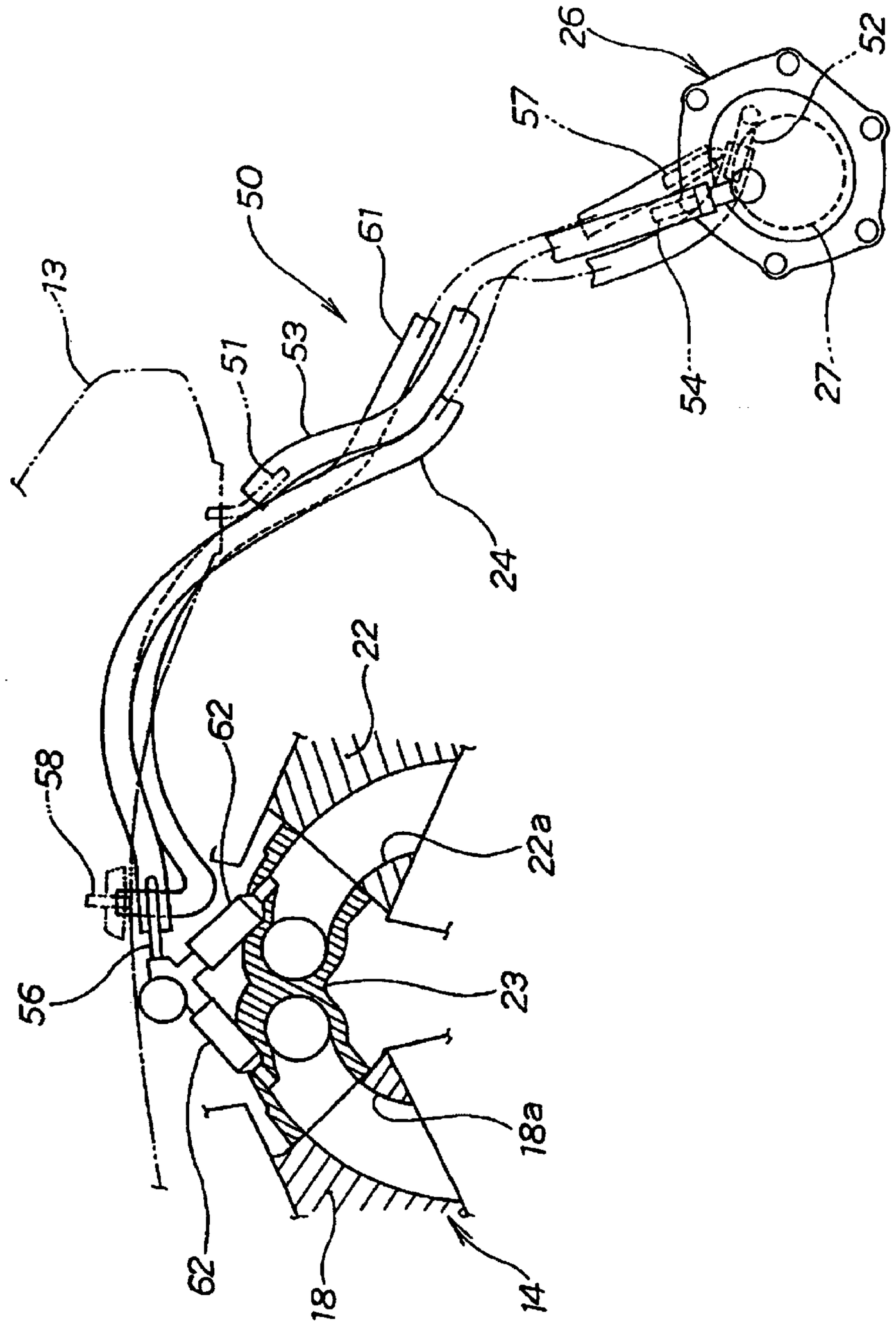

FIG. 3

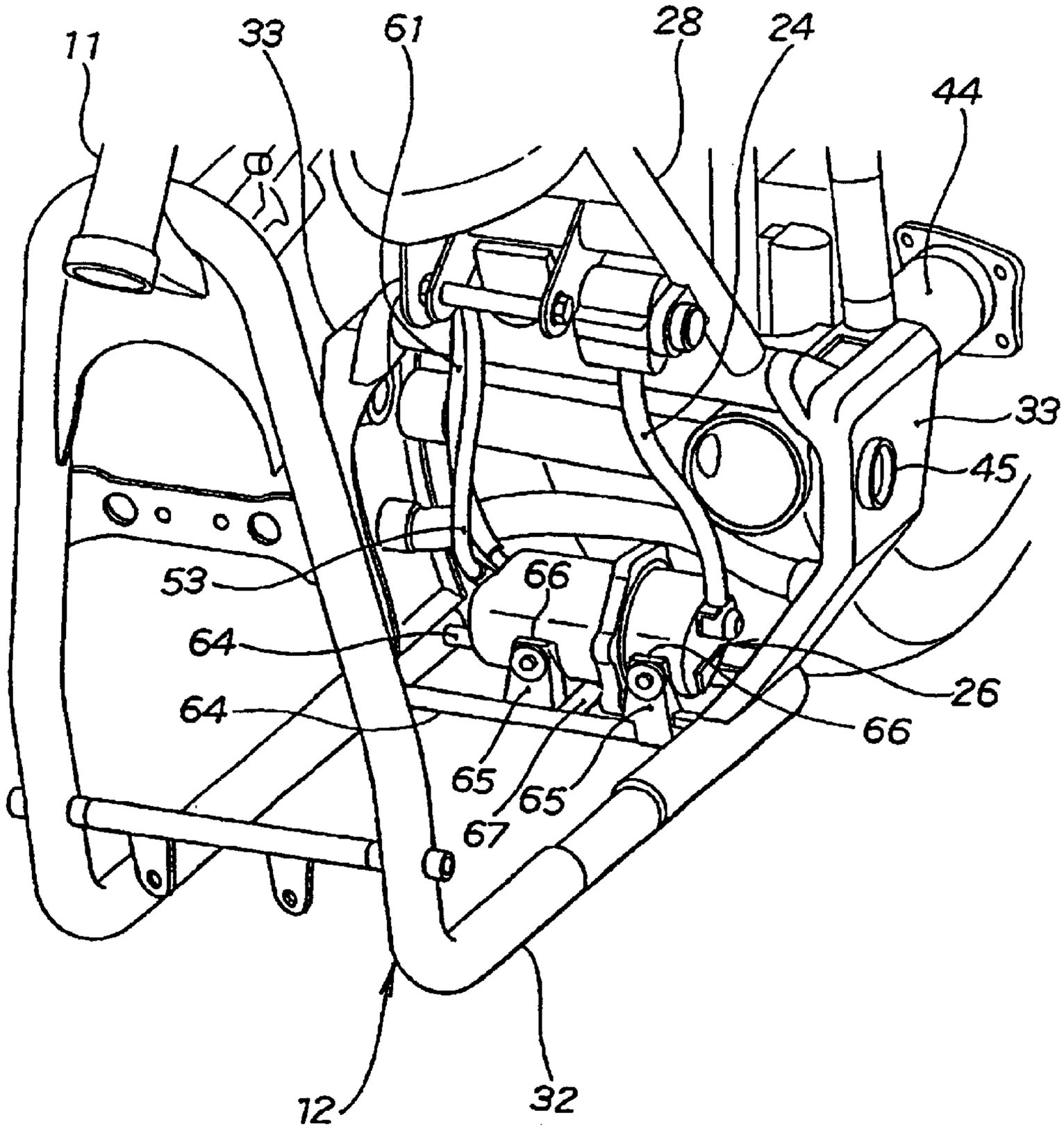

FIG. 4

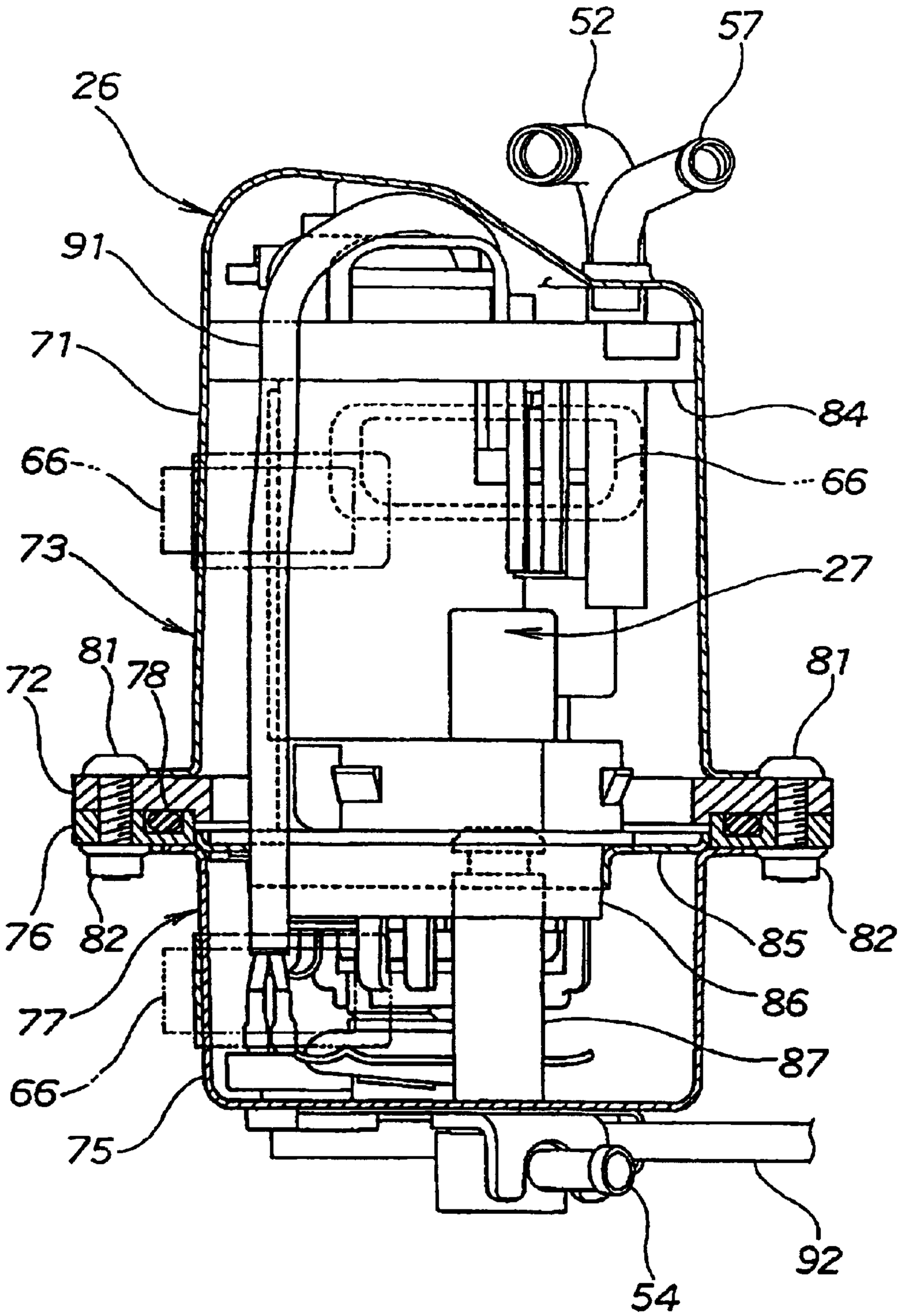
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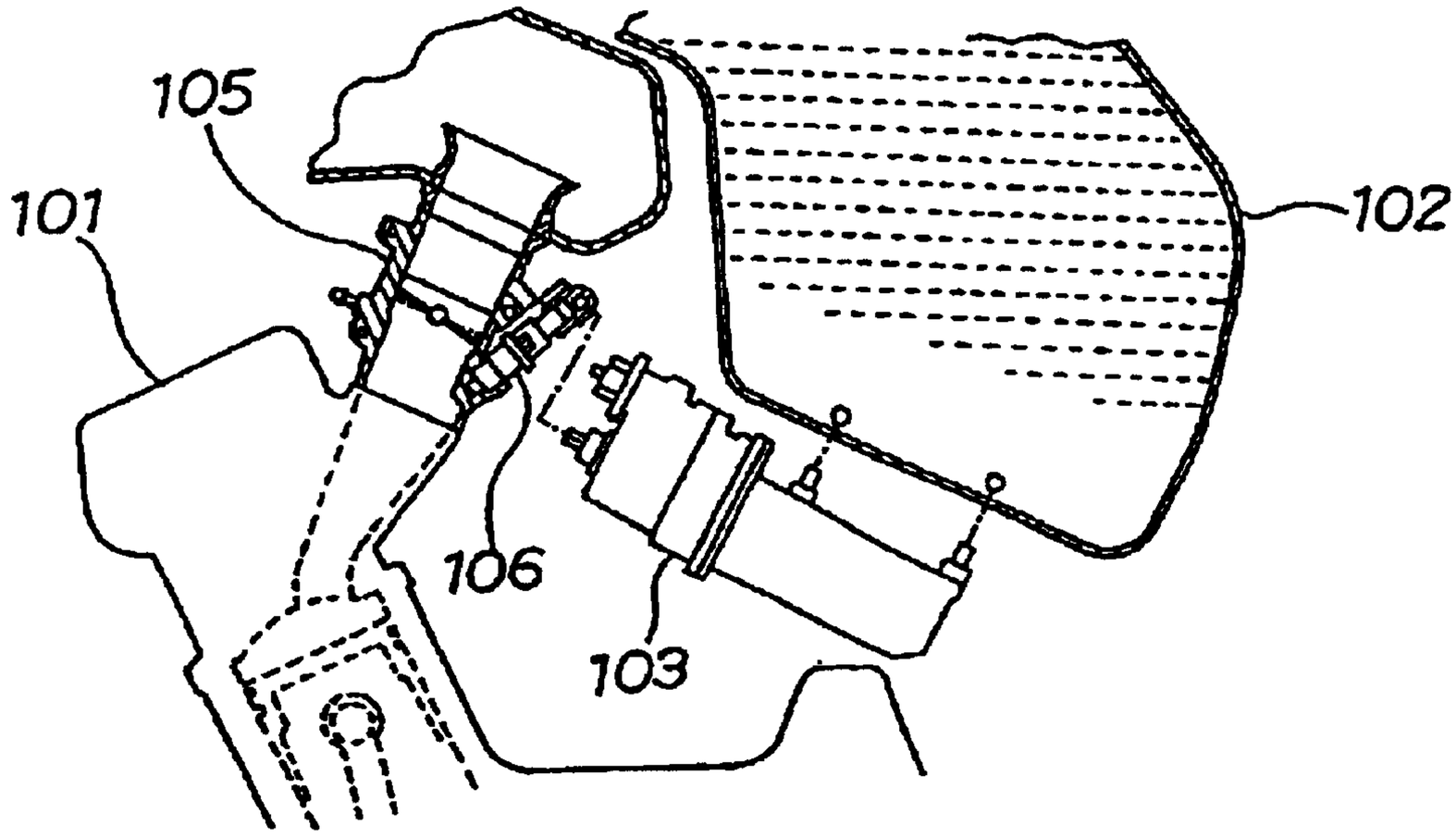
FIG. 5
(PRIOR ART)



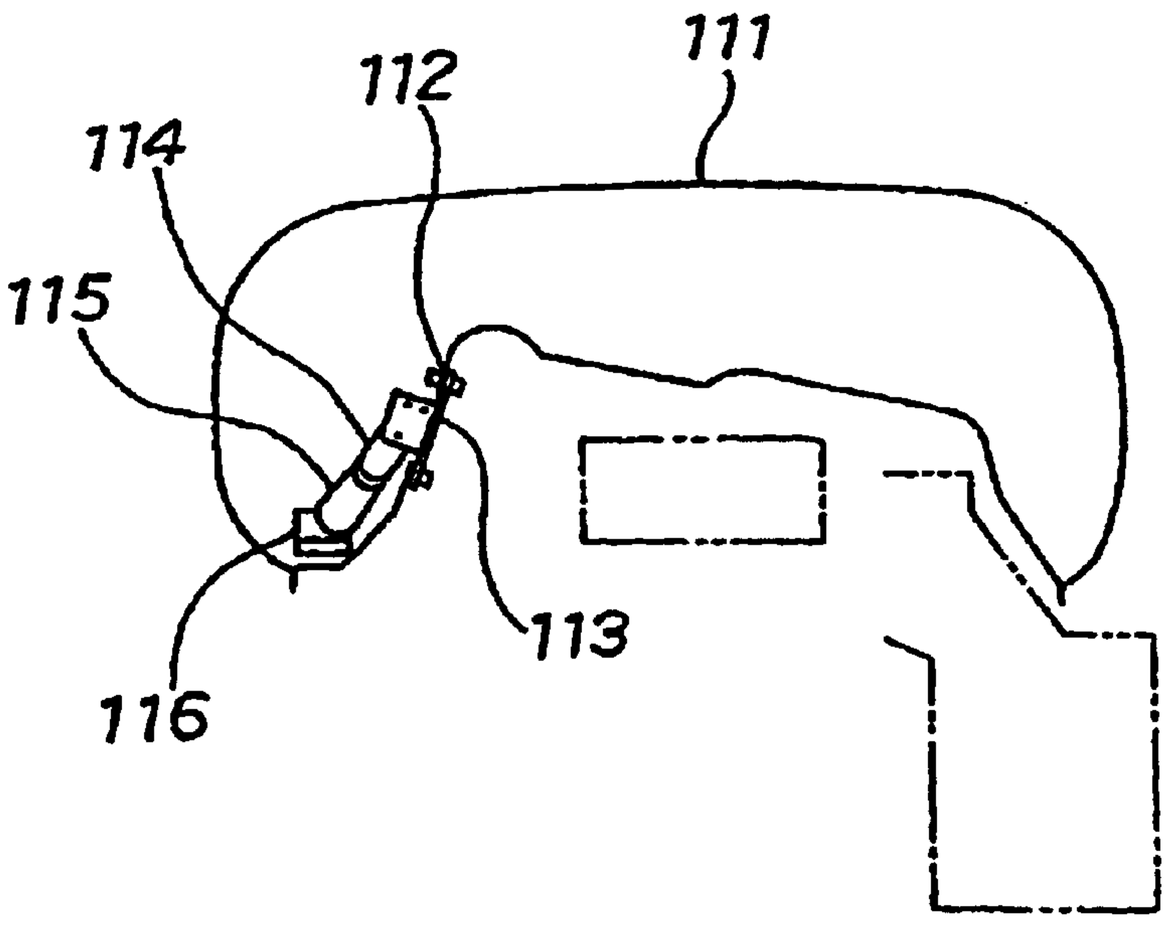


FIG. 6
(PRIOR ART)

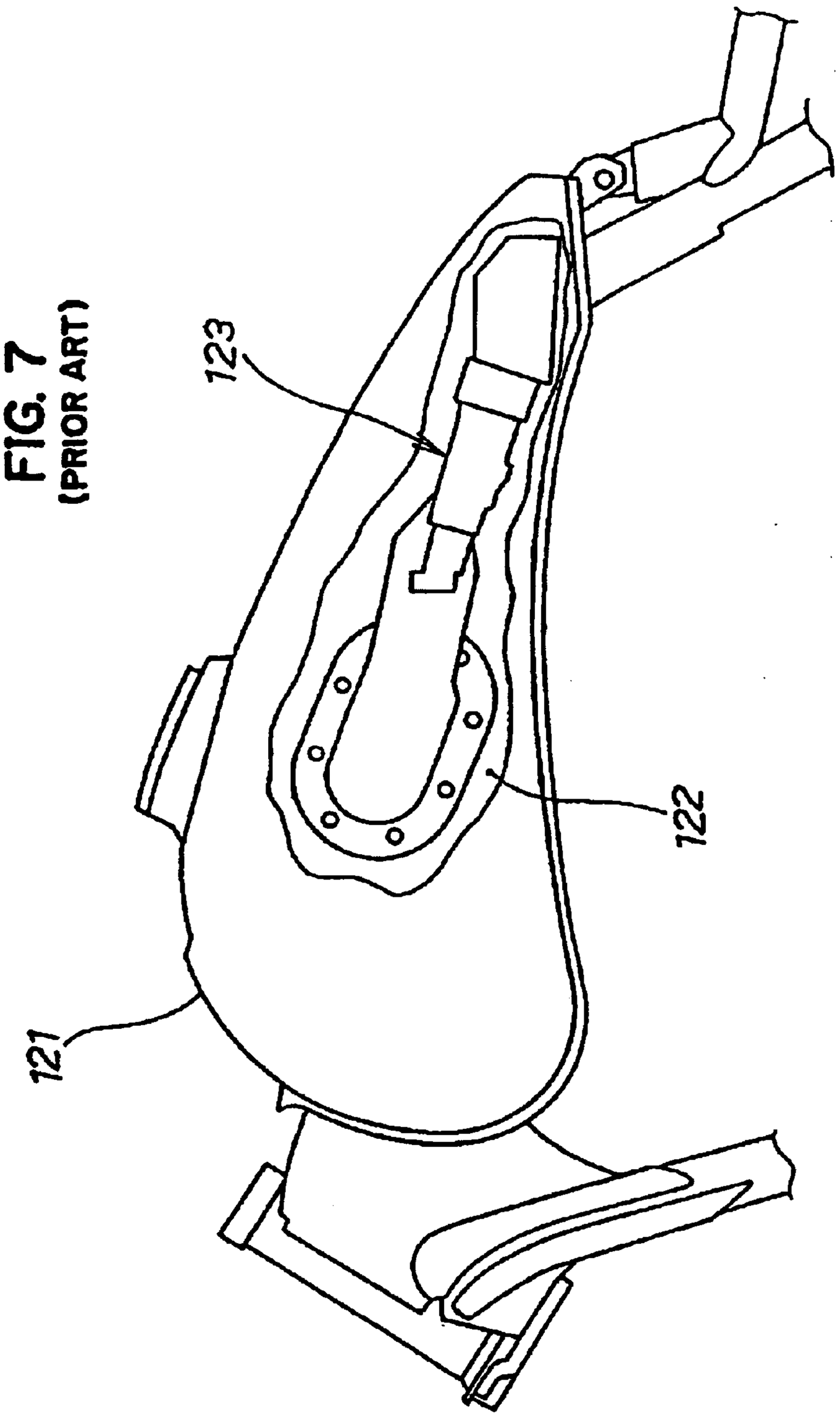


FIG. 7
(PRIOR ART)

LAYOUT STRUCTURE OF THE FUEL PUMP OF A MOTORCYCLE

FIELD OF THE INVENTION

The present invention relates to a layout structure of a fuel pump of a motorcycle.

BACKGROUND OF THE INVENTION

As layout structures of a fuel pump of a motorcycle, Japanese unexamined patent publication No. 2000-297711 discloses a structure in which a fuel pump is disposed near an engine. Japanese unexamined patent publication No. 2002-106440 discloses a structure in which a fuel pump is disposed in a fuel tank

The structure disclosed by publication No. 2000-297711 will be described with reference to FIG. **5** and the structure disclosed by publication No. 2002-106440 will be described with reference to FIG. **6**.

FIG. **5** is a cross section showing a conventional layout structure of a fuel pump of a motorcycle and illustrates that a fuel case **103** in which a fuel pump is housed is disposed above an engine **101** and below a fuel tank **102**. The layout includes a throttle body **105**, and a fuel injection valve **106** attached to the throttle body **105**. The fuel case **103** is shown not in a cross section but in a side view for convenience. The fuel case **103** for housing the fuel pump is disposed near the engine **101**, so that the fuel case **103** is easily heat-affected. When the fuel case **103** is disposed near the fuel tank **102**, the degree of freedom of connection between the fuel case **103** and the fuel tank **102** decreases, and a processed shape of a bottom wall of the fuel tank **102** becomes complicated.

FIG. **6** is a cross section showing another conventional layout structure of a fuel pump of a motorcycle. A mounting flange **112** is attached to an inner surface of a fuel tank **111**. A center portion of the mounting flange **112** is covered with a base plate **113**, a strainer **114** is attached to the base plate **113**, a fuel pump **115** is coupled to the strainer **114**, and a fuel filter **116** is connected to the fuel pump **115**. When the fuel pump **115** is attached in the fuel tank **111**, the degree of freedom of attachment of the fuel pump **115** is limited by the shape of the fuel tank **111**. Particularly, in an American-type vehicle having the flat fuel tank **121** shown in FIG. **7**, the shape and dimensions of the fuel pump apparatus **123** are also limited.

FIG. **7** shows a layout structure of a fuel pump in an American-type motorcycle. FIG. **7** is a partly-sectional side view showing a conventional layout structure of a fuel pump of a motorcycle. A fuel tank **121** of an American-type motorcycle (a vehicle called a "custom vehicle") has a thin and flat shape having a large dimension in the longitudinal direction and a small dimension in the vertical direction (so-called a teardrop (water drop) shape). FIG. **7** shows that a fuel pump apparatus **123** which includes a strainer, a pump body, and a motor and is long in the longitudinal direction is attached to an inner wall **122** of the fuel tank **121**.

An object of the invention is, therefore, to improve a layout structure of a fuel pump of a motorcycle, thereby increasing resistance to thermal effects of an engine, facilitating connection to a fuel tank, and increasing the degree of freedom of layout for a vehicle body.

SUMMARY OF THE INVENTION

To achieve the object, a layout structure of a fuel pump of in a motorcycle comprising a front wheel suspended in a front portion of a body frame, a rear wheel suspended by a rear-wheel suspending part provided in a rear portion of the body frame, a fuel tank attached in an upper portion of the body frame, an engine attached in a lower portion of the body frame, a fuel injection valve provided on an intake side of the engine, and fuel in the fuel tank supplied to the fuel injection valve by a fuel pump, wherein the fuel pump is attached to the body frame near the rear wheel suspending part.

By attaching the fuel pump to the body frame near the rear-wheel suspending part, the degree of freedom of layout of the fuel pump can be increased and the fuel pump can be disposed in a position far from the engine, so that thermal effects of the engine onto the fuel pump can be suppressed. Further, since it is sufficient to attach a pipe for connecting a fuel pipe to the fuel tank, processing of the fuel tank can be suppressed to the minimum. Further, as compared with the case where the fuel pump is disposed in the fuel tank, in the invention, the degree of freedom of designing of the fuel pump can be increased. Moreover, by attaching the fuel pump to the body frame near the rear-wheel suspending part, the fuel pump can be protected by the surrounding body frame.

Further, the fuel pump may be disposed in a fuel case. The fuel pump can be protected by the fuel case more reliably. For example, the fuel pump can be protected from being hit by flying gravel or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of a motorcycle employing a fuel pump layout structure according to the invention.

FIG. **2** is a diagram illustrating piping of the fuel pump layout structure according to the invention.

FIG. **3** is a perspective view showing the fuel pump layout structure according to the invention.

FIG. **4** is a cross section of a sub tank according to the invention.

FIG. **5** is a cross section showing a conventional fuel pump layout structure of a motorcycle.

FIG. **6** is a cross section showing a conventional fuel pump layout structure of a motorcycle.

FIG. **7** is a side view showing a conventional fuel pump layout structure of a motorcycle.

DETAILED DESCRIPTION OF THE INVENTION

An embodiment of the present invention will be described herein below with reference to the attached drawings. The drawings are to be seen from the direction of reference numerals.

FIG. **1** is a side view of a motorcycle employing a fuel pump layout structure according to the invention. A motorcycle **10** is a vehicle in which a body frame **12** extends rearward from a head pipe **11**, a fuel tank **13** is attached on the body frame **12**, a V-shaped 2-cylinder engine **14** and a transmission **15** provided integrally with the engine **14** are attached on the inner side of the body frame **12**, a throttle body **23** is provided between a front-side cylinder **17** (specifically, a front-side cylinder head **18**) and a rear-side cylinder **21** (specifically, a rear-side cylinder head **22**) of the engine **14**, a fuel pump **27** in a sub tank **26** as a fuel case is connected to the throttle body **23** via a high-pressure pipe **24**, and the fuel tank **13** is connected to the sub tank **26** via a not-shown fuel pipe.

The body frame **12** is constructed by a main pipe **28** extended rearward from the head pipe **11** and extended

obliquely downward to the rear side, a seat rail **31** extended rearward from some midpoint of the main pipe **28**, a down pipe **32** extended obliquely downward to the rear side from the head pipe **11** and extended rearward, a rear-wheel suspending part **33** for coupling a tip of the main pipe **28** and a tip of the down pipe **32**, and a sub pipe **34** extended from the rear-wheel suspending part **33** to the seat rail **31**.

The sub tank **26** is a part disposed on the inside of the rear-wheel suspending part **33** and housing therein a fuel pump which will be described later.

A front fork **41** is steerably attached to the head pipe **11** and to whose lower end a front wheel is attached. A handle **42** is attached to the top portion of the front fork **41**. Also shown are a seat **43**, a swing arm **44** housing a drive shaft for transmitting power from the transmission **15** to the rear wheel and to whose rear end the rear wheel is attached, a swing shaft **45** of the swing arm **44**, a rear cushion unit **46** extended between the rear portion of the swing arm **44** and the seat rail **31**, and a rear fender **47** covering an upper portion of the rear wheel.

FIG. **2** is a diagram illustrating piping of the fuel pump layout structure according to the invention. Fuel supply equipment **50** for supplying fuel from the fuel tank **13** to the engine **14** includes the fuel tank **13**, a supply pipe **53** connected from a discharge pipe **51** provided in a rear lower part of the fuel tank **31** to a suction pipe **52** of the sub tank **26**, the high-pressure pipe **24** connected from a high-pressure discharge pipe **54** provided for the sub tank **26** to a distribution pipe **56** on the throttle body **23** side, a return pipe **61** connected from a return discharge pipe **57** provided for the sub tank **26** to a return intake pipe **58** provided in a lower portion of an almost center portion of the fuel tank **13**, and fuel injection valves **62** and **62** connected to the distribution pipe **56** and also attached to the throttle body **23**.

The supply pipe **53** is a pipe for supplying fuel from the fuel tank **31** to the sub tank **26**. The high-pressure pipe **24** is a pipe for supplying fuel of which pressure is increased to a predetermined pressure from the fuel pump **27** in the sub tank **26** to the fuel injection valves **62** and **62** via the distribution pipe **56**. The return pipe **61** is a pipe for returning the fuel in the sub tank **26** to the fuel tank **13** by the action of a not-shown pressure adjusting valve when the pressure of supply fuel is high in order to supply fuel of predetermined pressure to the fuel injection valve **62**. The fuel injection valve **62** is a valve which is intermittently opened/closed in accordance with a signal from a not-shown engine control unit to thereby inject the fuel to intake ports **18***a* and **22***a* of the engine **14**.

FIG. **3** is a perspective view showing the fuel pump layout structure according to the invention, in which two cross members **64** and **64** are extended in parallel with each other in the longitudinal direction in a rear end portion of the down pipe **32** in the body frame **12**, three sub tank brackets **65** (out of which two sub tank brackets **65** on the front side are shown) are attached to the cross members **64** and **64**, and the sub tank **26**. Mounting parts **66** provided for the sub tank **26** are attached to the sub tank brackets **65**. A beam **67** extends in a center portion of each of the front and rear cross members **64** and **64**.

Since sides of the body are covered with the plate-shaped rear-wheel suspending parts **33** and **33** as components of the body frame **12** and the cross members **64** and **64** and the beam **67** are disposed below the sub tank **26**, the sub tank **26** can be protected with reliability by the rear-wheel suspending parts **33** and **33**, the cross members **64** and **64**, and the beam **67**. Further, since the fuel pump **27** (refer to FIG. **1**) is housed in the sub tank **26**, the fuel pump **27** is protected more reliably.

A space on the inside of the rear-wheel suspending parts **33** and **33** exists below the swing shaft **45** of the swing arm **44** and is relatively large. In the invention, by disposing the sub tank **26** in such a space, the space on the inside of the body frame **12** can be effectively used.

FIG. **4** is a cross section of the sub tank **26** according to the invention. The sub tank **26** is constructed by: a first case half-body **73** made by a first cup member **71** having a bottomed cylindrical shape and a first flange member **72** of which outer shape attached to an opening of the first cup member **71** is an almost ellipse shape and is annular, a second case half-body **77** made by a second cup member **75** having a bottomed cylindrical shape and a second flange member **76** of which outer shape attached to an opening of the second cup member **75** is an almost ellipse shape and is annular, and an O ring **78** which is fit in the second flange member **76** to thereby seal the first and second flange members **72** and **76**. The first and second case half-bodies **73** and **77** are coupled to each other via bolts **81** and nuts **82**.

The suction pipe **52** and the return discharge pipe **57** are members attached to an end of the first cup member **71**, and the tip of the suction pipe **52** is inserted in the first cup member **71** more deeply than that of the return discharge pipe **57**.

The fuel pump **27** is supported by the first case half-body **73** via a supporting rubber **84**, supported by the second case half-body **77** via an annular plate **85** and a supporting rubber **86** provided on the inside of the annular plate **85**, and connected to the high-pressure discharge pipe **54** via a discharge-side coupling pipe **87**. Also shown are a conductor **91** on the inside of the case and a conductor **92** on the outside of the case for energization in order to drive the fuel pump **27**.

As described with reference to FIGS. **1**, **2**, and **3**, the invention is characterized in that, in the motorcycle **10** in which the front wheel is suspended on the front side of the body frame **12**, the rear wheel is suspended by the rear-wheel suspending part **33** provided in a rear portion of the body frame **12**, the fuel tank **13** is attached in an upper portion of the body frame **12**, the engine **14** is attached in a lower portion of the body frame **12**, the fuel injection valve **62** is provided on the intake side of the engine **14**, and fuel in the fuel tank **13** is supplied to the fuel injection valve **62** by the fuel pump **27**, the fuel pump **27** is attached to the body frame **12** near the rear wheel suspending part **33**, specifically, the cross members **64** and **64** attached to the down pipe **32**.

By attaching the fuel pump **27** to the body frame **12** near the rear-wheel suspending part **33**, the degree of freedom of layout of the fuel pump **27** can be increased and the fuel pump **27** can be disposed in a position far from the engine **14**, so that thermal effects of the engine **14** onto the fuel pump **27** can be suppressed. Further, since it is sufficient to attach pipes (the discharge pipe **51** and the return intake pipe **58**) for connecting fuel pipes (the supply pipe **53** and the return pipe **61**) to the fuel tank **13**, processing of the fuel tank **13** can be suppressed to the minimum. Further, as compared with the case where the fuel pump **27** is disposed in the fuel tank **13**, in the invention, the degree of freedom of designing of the fuel pump **27** can be increased.

Moreover, by attaching the fuel pump **27** to the body frame **12** near the rear-wheel suspending part **33**, the sub tank **26** housing the fuel pump **27** can be protected by the surrounding body frame **12**, specifically, the rear-wheel suspending parts **33** and **33**, cross members **64** and **64**, and beam **67**. Therefore, a tank guard member for guarding the

sub tank **26** becomes unnecessary and the cost can be reduced. Further, the fuel pump **27** can be protected by the sub tank **26** more reliably. For example, the fuel pump **27** can be protected from a hit of a flying gravel or the like.

In the layout structure of the fuel pump of the motorcycle of claim **1**, the fuel pump is attached to the body frame near the rear-wheel suspending part. Thus, the degree of freedom of layout of the fuel pump can be increased and the fuel pump can be disposed in a position far from the engine, so that thermal affection of the engine onto the fuel pump can be suppressed.

Further, since it is sufficient to attach pipes for connecting fuel pipes to the fuel tank, processing of the fuel tank can be suppressed to the minimum. Further, as compared with the case where the fuel pump is disposed in the fuel tank, in the invention, the degree of freedom of designing of the fuel pump can be increased. Moreover, by attaching the fuel pump to the body frame near the rear-wheel suspending part, the fuel pump can be protected by the surrounding body frame.

In the layout structure of the fuel pump of the motorcycle of claim **2**, the fuel pump is disposed in the fuel case. Consequently, the fuel pump can be protected by the fuel case more reliably. The fuel pump can be protected from being hit by flying gravel or the like.

Although the embodiments of the present invention has been described thus far, the engine control unit of the present invention is not limited to the example in the drawings described above, various modification may be made without departing the scope of the present invention, as a matter of course.

We claim:

1. A layout structure of a fuel pump of a motorcycle comprising a front wheel suspended on the front side of a body frame, a rear wheel suspended by a pair of rear-wheel suspending parts provided in a rear portion of the body frame, a fuel tank attached in an upper portion of the body frame, an engine attached in a lower portion of the body frame, a fuel injection valve provided on an intake side of the engine, and fuel in said fuel tank supplied to the fuel injection valve by a fuel pump, a rear swing arm swingably supported on and between the pair of rear wheel suspending parts

wherein the fuel pump is disposed in a space defined between the pair of rear wheel suspending parts and below a swing shaft of the swing arm.

2. The layout structure of a fuel pump of a motorcycle according to claim **1**, wherein said fuel pump is disposed in a fuel case.

3. The layout structure of a fuel pump of a motorcycle according to claim **2**, wherein the fuel case is attached to said body frame near said rear wheel suspending part.

4. The layout structure of a fuel pump of a motorcycle according to claim **2** further comprising a cross member for mounting the fuel case wherein the cross member is attached to a rear end portion of a down pipe of the body frame.

5. The layout structure of a fuel pump of a motorcycle according to claim **4** comprising a plurality of cross members for mounting the fuel case extending in parallel with each other and a beam extending between the cross members.

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